

# Paper Use

## Energy and Environmental Impacts

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All statistics are for the United States. Paper shipments are conventionally measured in short tons (2000 pounds). “Tons” should be taken to mean short tons; metric tonnes (2200 pounds) are referred to as such.

### *Paper use in the U.S.<sup>1</sup>*

- Every year the U.S. consumes over 90 million tons of paper in the form of newsprint, printing and writing paper, cardboard, tissue, etc.
- About 7.6 million tons of paper are used in offices each year.<sup>2</sup>
- About 3.5 million tons of copy paper (paper used in copiers, fax machines and computer printers) are used in homes and offices each year.
- The average worker consumes 10,000 sheets of copy paper per year. To put that in perspective, a 10,000 sheet stack of unused paper stands over 4 feet high and weighs about 100 pounds. This is the equivalent of about 40 sheets per worker every working day.

### *Paper and energy use*

Paper production consumes energy at every stage, beginning with forestry and chemical production (the material inputs to paper production), transporting the inputs, and finally the paper production process itself, including pulping, papermaking and converting (unrolling, cutting, packing and wrapping the paper into the final consumer product). Even though process improvements in pulping and papermaking have significantly reduced the per-ton cost of paper production, total energy use by the industry has continued to grow as Americans consume more and more paper.<sup>3</sup>

- The paper industry accounted for over 3% of all U.S. energy use in 1991.<sup>4</sup>
- The energy content of office paper from virgin fiber is 17 watt-hours of energy (in fuel and electricity) per sheet.<sup>5</sup> This adds up to 3400 kilowatt-hours (11.6 million Btus) per ton of paper. At 10,000 sheets per year, a worker consumes as much energy in paper as he would burning five gallons of gasoline.
- The energy content of 100% recycled paper is only about 12 watt-hours per sheet. This adds up to 2400 kilowatt-hours (8.19 million Btus) per ton of paper. At 10,000 sheets per year, a worker consumes the energy equivalent of more than three gallons of gasoline in paper each year.
- Assuming an average energy content of 3200 kilowatt-hours per ton, the production of copy paper alone consumes 11.2 billion kilowatt-hours of fuel and electricity (38 trillion Btus).

### *Greenhouse gas emissions due to paper production*

Paper production involves many different processes and consumes various types of fuel. Wood (forestry by-products such as bark), gas, or oil is used to fire the boilers during the pulping process; diesel is required for transportation; and electricity is used in the final converting

processes. Each of these fuels produces greenhouse gases. Additional greenhouse gases are produced as waste paper degrades in landfills.

- Based on a breakdown of energy inputs to the various stages of paper production, the production of U.S. office paper produces 0.29 metric tonnes of carbon per ton of paper.<sup>6</sup> The production of copy paper alone contributes about one million metric tonnes of carbon per year toward global warming.

#### *Expenditures on office paper*

- The long run average cost of office paper in the U.S. is \$1000 per ton, or 0.5 cents per sheet.
- Purchases of copy paper cost about \$3.5 billion per year.
- A single copier, producing 10,000 copies per month, can consume \$600 per year in paper if all copies are single-sided.
- Storing all this paper entails additional costs in the form of filing cabinets, floor space committed to paper storage, and archival costs.
- For every dollar in paper costs, an additional \$1.60 is spent on mailing costs.<sup>7</sup>
- Imaging, storage, and mailing can increase the total cost of handling paper tenfold over the purchase price: \$10,000 per ton in total costs for a typical firm.<sup>8</sup>

#### *Increasing paper use efficiency*

One easy way to decrease paper consumption is by increasing the duplexing rate for copiers. Duplexing rates vary widely among offices and even among copiers within the same office. Since newer, high capacity copiers tend to have better, easier-to-use duplexing features, such copiers tend to have higher duplexing rates.

- The national average duplexing rate is about 26%.<sup>9</sup> This means that 26 out of every 100 images reproduced are placed on double-sided paper, so that only 87 sheets are required, compared to 100 sheets without any duplexing.
- Increased duplexing rates could potentially reduce paper use by copiers by an additional 10% or more--over 175,000 tons per year nationally.<sup>10</sup> That's \$175 million in paper purchases, 560 million kilowatt-hours in fuel and electricity saved and about 50,000 metric tonnes of avoided carbon emissions every year.
- Reducing the number of sheets used also reduces mailing and storage costs.

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<sup>1</sup>Unless otherwise noted, energy use figures are from work by Bruce Nordman, Lawrence Berkeley National Laboratory. Calculations assume 20 lb office paper, 8.5 x 11 inch sheets. There are approximately 200,000 sheets per ton of 20 lb paper.

<sup>2</sup>Franklin Associates, Ltd., "Supply of and Recycling Demand for Office Waste Paper, 1990 to 1995," Prepared for the National Office Paper Recycling Project, 1991.

<sup>3</sup>American Forest and Paper Association, "Statistics of Paper, Paperboard and Woodpulp," 1993.

<sup>4</sup>American Forest and Paper Association, 1993.

<sup>5</sup>From work by Bruce Nordman, Lawrence Berkeley National Laboratory.

<sup>6</sup>Based on production process energy consumption breakdown by Bruce Nordman, Lawrence Berkeley

<sup>7</sup>Based on the analysis of a typical firm by Bruce Nordman, Lawrence Berkeley National Laboratory.

<sup>8</sup>Based on the analysis of a typical firm by Bruce Nordman, Lawrence Berkeley National Laboratory.

<sup>9</sup>Graff, R. and B. Fishbein, "Reducing Office Paper Waste," INFORM, Inc., New York, NY, 1991.

<sup>10</sup>Only half of all copy paper (1.75 million tons) is actually used in copiers.